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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/802,084
Filing Date: March 08, 2001
Appellant(s): OOI ET AL.

Henry I. Steckler
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed September 25, 2003.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The brief does not contain a statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief. Therefore, it is presumed that there are none. The Board, however, may exercise its discretion to require an explicit statement as to the existence of any related appeals and interferences.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 1-16 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

Re.33,74	Burnham et al.	7-1990
5,757,023	Koteles et al	5-1998
6,071,652	Feldman et al.	6-2000
6,124,147	Shim et al.	9-2000
2002/0072142	Ooi et al.	7-2001
2002/0127752	Thompson et al	5-2002

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 4, 5, 6, 7, 8 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Burnham et al., U. S. Patent Re. 33,274.

3. Burnham teaches a semiconductor process as claimed.

Pertaining to claim 1, see **FIGS. 1-5**, where Burnham teaches a method of manufacturing a photonic integrated circuit comprising a compound semiconductor structure having a quantum well region 54, comprising the steps of irradiating the structure using a source of photons (i.e., laser, column 2, lines 1-5) to generate defects, the photons having an energy (E) at least that of

the displacement energy ($E_{,,}$) of at least one element of the compound semiconductor, and subsequently annealing the structure to promote quantum well intermixing.

4. Pertaining to claim 4, Burnham teaches a method according to claim 1, in which the radiation source is one selected from a group consisting of electrical gas discharge devices **44**, excimer lasers, synchrotron devices, flash x-ray devices and gamma ray sources.

5. Pertaining to claim 5, Burnham teaches a method according to claim 1, including the step of masking a portion **62** (also see claims 4 and 5) of the structure to control the degree of radiation damage.

6. Pertaining to claim 6, Burnham teaches a method according to claim 5, in which the mask is adapted to prevent intermixing entirely.

7. Pertaining to claim 7, Burnham teaches a method according to claim 5, in which the structure is masked in a differential manner to selectively intermix the structure in a spatially controlled manner by controlling the exposure of portions of the structure in a predetermined manner (mask **60**).

8. Pertaining to claim 8, Burnham teaches a method according to claim 5, in which the mask is selected from a group consisting of binary masks, phase masks, gray, masks, dielectric or metal masks, and photoresist masks.

9. Pertaining to claim 9, Burnham teaches a method according to claim 1, in which spatial control of intermixing is controlled using a variable profile mask pattern.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 2, 3 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burnham U.S. Patent Re. 33,274 as applied to claims 1, 4, 5, 6, 7, 8 and 9 above, and further in view of Thompson et al., U.S. Patent Application Publication No. US 2002/0127752 A1.

12. Burnham discloses a semiconductor process substantially as claimed as discussed above.

Pertaining to claim 2, Burnham fails to teach a method according to claim 1, in which the radiation source is a plasma. Thompson teaches a method wherein the radiation source is a plasma [0030]. In view of Thompson, it would have been obvious to one of ordinary skill in the art to incorporate the plasma source of Thompson into the Burnham semiconductor process because a first defect layer is grown [0030, lines 17-20].

13. Pertaining to claim 3, Burnham fails to teach a method according to claim 2, in which the plasma source is generated using an electron cyclotron resonance (ECR) system, an inductively coupled plasma (ICP) system, a plasma disk excited by a soft vacuum electron beam, or plasma soft x-ray (SFR) devices. Thompson teaches a method according to claim 2, in which the plasma source is generated using an electron cyclotron resonance (ECR) system, an inductively coupled plasma (ICP) system, a plasma disk excited by a soft vacuum electron beam, or plasma soft x-ray (SFR) devices. In view of Thompson, it would have been obvious to one of ordinary skill in the art to incorporate the process steps of Thompson into the Burnham semiconductor process because a first defect layer is grown [0030, lines 17-20].

14. Pertaining to claim 16, Burnham in view of Thompson fail to teach a method according to claim 1, in which an electron cyclotron resonance system is used to generate a plasma, wherein the microwave power of the ECR system is between 300 and 3000 W, more preferably between 1000 and 2000 W, the process temperature is between 25 and 500^0 C, more preferably between 25 and 200^0 C, the process pressure is between 0. 1 and 100 mtorr, more preferably between 20 and 50 mtorr, and the exposure time is between 30 seconds and 1 hour, more preferably between 4 and 14 minutes.

15. Given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)

Appellants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. *Ex parte Ishizaka*, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

16. Claims 10, 11, 12, 13, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burnham et al., U.S. Patent Re. 33,274 as applied to claims 1 and 4-9 above, and further in view of Poole et al., U.S. Patent 6,027,989 and Feldman et al., U.S. Patent 6,071,652.

17. Pertaining to claim 10, Burnham discloses a semiconductor process substantially as claimed. However, Burnham fails to teach a method according to claim 1 further comprising the steps of forming a photoresist on the structure and differentially exposing regions of the photoresist in a spatially selective manner in dependence on the degree of quantum well intermixing required, and subsequently developing the photoresist. Poole teaches a method of comprising the steps of forming a photoresist on the structure and differentially exposing regions of the photoresist in a spatially selective manner in dependence on the degree of quantum well intermixing required, and subsequently developing the photoresist. See **FIG. 7** where Poole teaches the steps of forming a photoresist on the structure and differentially exposing regions of the photoresist in a spatially selective manner in dependence on the degree of quantum well intermixing required, and subsequently developing the photoresist. In view of Poole, it would have been obvious to one of ordinary skill in the art to incorporate the process steps of Poole into the Burnham semiconductor process because by varying the thickness different defect concentrations are created in different regions (column 3, lines 11-12). However, Poole fails to disclose that the mask **12, 14** and **16** above the dielectric is a photoresist. Feldman discloses the use of photoresist. See **FIG. 3**, where Feldman discloses a contact mask with photoresist. In view of Feldman, it would have been obvious to one of ordinary skill in the art to incorporate

photoresist into the combined teachings of Burnham and Poole because the photoresist is used to transfer the desired optical element (column 2, lines 41-42).

18. Pertaining to claim 11, the combined teachings discloses a method according to claim 10, comprising the step of applying an optical mask to the photoresist and exposing the photoresist through the optical mask, the optical mask having an optical transmittance that varies in a spatially selective manner.

19. Pertaining to claim 12, the combined teachings discloses a method according to claim 11, in which the optical mask is a Gray scale mask (see title of Feldman).

20. Pertaining to claim 13, the combined teachings discloses a method according to claim 10, in which the photoresist is applied to a masking layer.

21. Pertaining to claim 14, the combined teachings disclose a method according to claim 13, in which the masking layer is a dielectric.

22. Pertaining to claim 15, the combined teachings disclose a method according to claim 13, further comprising the steps of etching the structure with the developed photoresist in situ to provide a differentially etched masking layer.

(11) Response to Argument

23. The amendment filed January 21, 2003 in paper no. 9 has been reviewed, however, not very persuasive.

24. Applicants contend the rejection of claims 1, 4, 5, 6, 7, 8 and 9 under 35 U.S.C. § 102(b) is traversed because Applicants allege that Burnham et al., U.S. Patent Re:33,274 does not teach "irradiating...to generate defects..." and "annealing the structure...". Because theses limitations are missing from Burnham.

25. In response to Applicants contention that Burnham fails to teach the limitations of Claim 1, i.e., "irradiating...to generate defects..." and "annealing the structure...". These limitations are clearly disclosed by Burnham. Laser 28 produces a laser beam, Applicants should be aware that a laser beam emits photons which is a form of irradiating. The substrate is heated to improve the selective disorder (columns 3-4, lines 13-65).

26. Applicants contend that at item 4 of the detailed action the xenon lamp 44 as shown in FIG. 2 cannot introduce defects, since no defects are introduced into the quantum well.

27. In response to Applicants contention that Burnham fails to disclose a radiation source selected from a group consisting of electrical gas discharge devices, excimer lasers, synchrotron devices, flash x-ray devices and gamma ray sources. The Examiner indicates that a xenon lamp is an electrical gas discharge device as well as the laser discussed above, and therefore meets the limitations of the claim.

28. Applicant contends that Burnham does not teach the step of masking a portion of the structure to control the degree of radiation damage.

29. In response to Applicants contention that the silicon oxide layer 24 fails to provide a control of radiation damage, Applicants must provide a sworn affidavit for the rejection of claim 5 to be withdrawn.

30. In response to Applicants contention that Burnham fails to teach the structure is masked in a differential manner because the Examiner points to element 60. Please note that pattern layer 60 implies a mask region and therefore Applicants arguments are moot.

31. Applicants further contend that the rejection under 35 U.S.C. § 103 is improper because Burnham does not teach the introduction of point defects in the quantum well region.

32. In response to Applicants contention that Burnham fails to teach the introduction of point defects in the quantum well region, Applicants have not specifically pointed out the failure of Burnham's teaching with regards to Applicants claims.

33. Applicants contend that Burnham and Thompson fails to teach a method according to claim 2. Applicants further contend that the plasma ECR source is not a radiation source for the purpose of the Thompson document.

34. In response to Applicants contention that Thompson fails to teach a radiation source. It is well known in the art that an Electron Cyclotron Resonance device works in the microwave frequency range and is therefore a radiation source. The term radiation is generally accepted as transferring energy through air and/or a vacuum. Furthermore Thompson is pertinent to the Application because Thompson teaches a method of locally modifying the effective bandgap energy of compound semiconducting materials.

35. Applicants contend that the combination of Burnham, Poole and Feldman fails to teach a gray tone mask or a for that matter a photoresist as claimed in claim 10.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Poole teaches the use of a shadow masking technique (column 2, lines 55-56). One

of ordinary skill in the art would recognize that a shadow mask is merely nothing more than an equivalent to a gray tone mask.

36. The Double-Patenting rejection has been withdrawn.

For the above reasons, it is believed that the rejections should be sustained.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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WDC
June 9, 2004

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